

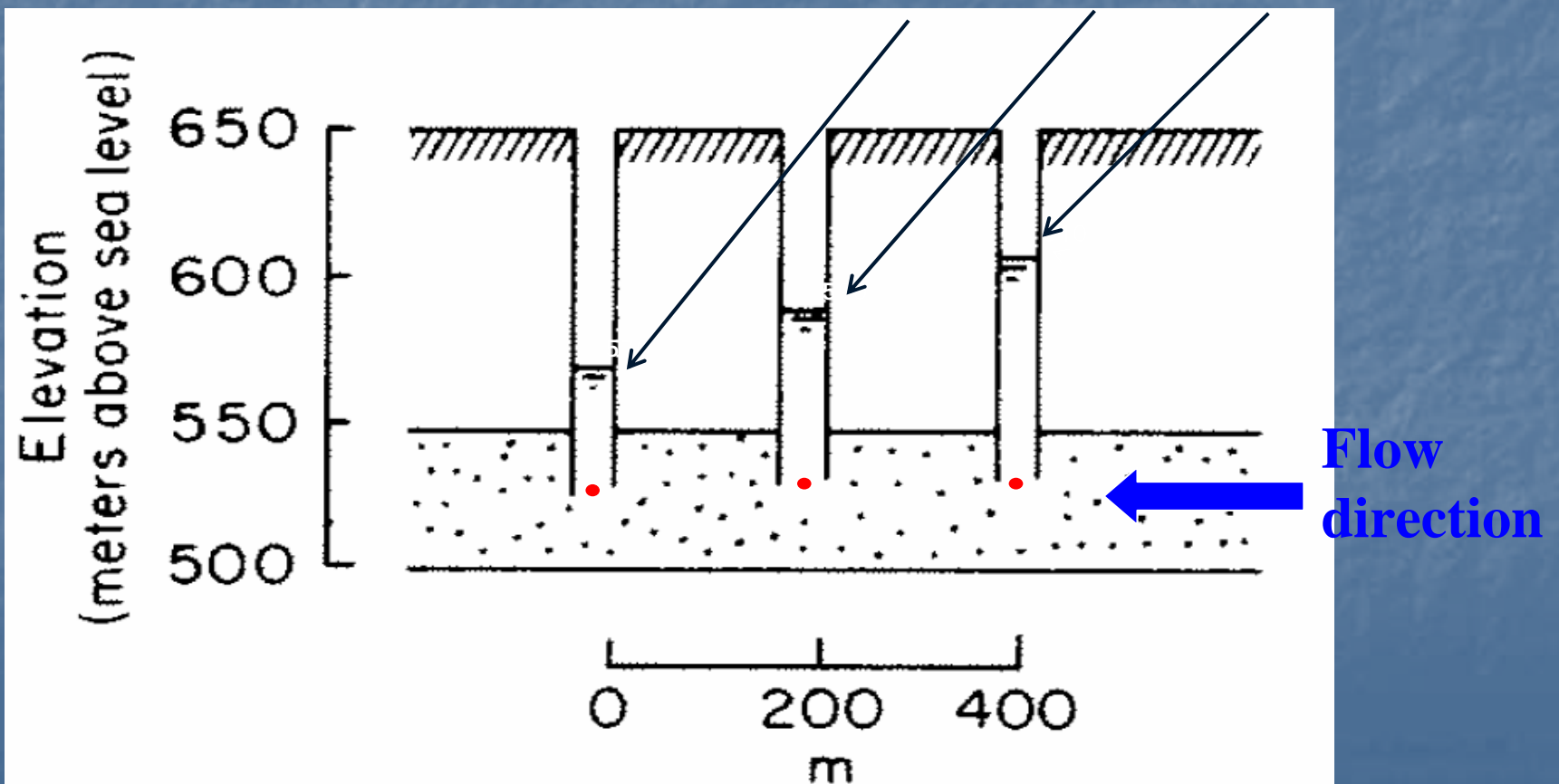
Measuring Water Levels

- Two main reasons:
 1. Measure groundwater gradients to calculate groundwater flow:
 - Horizontal;
 - Vertical;
 2. Measure water levels in a stream to calculate discharge;

Why measure water levels?

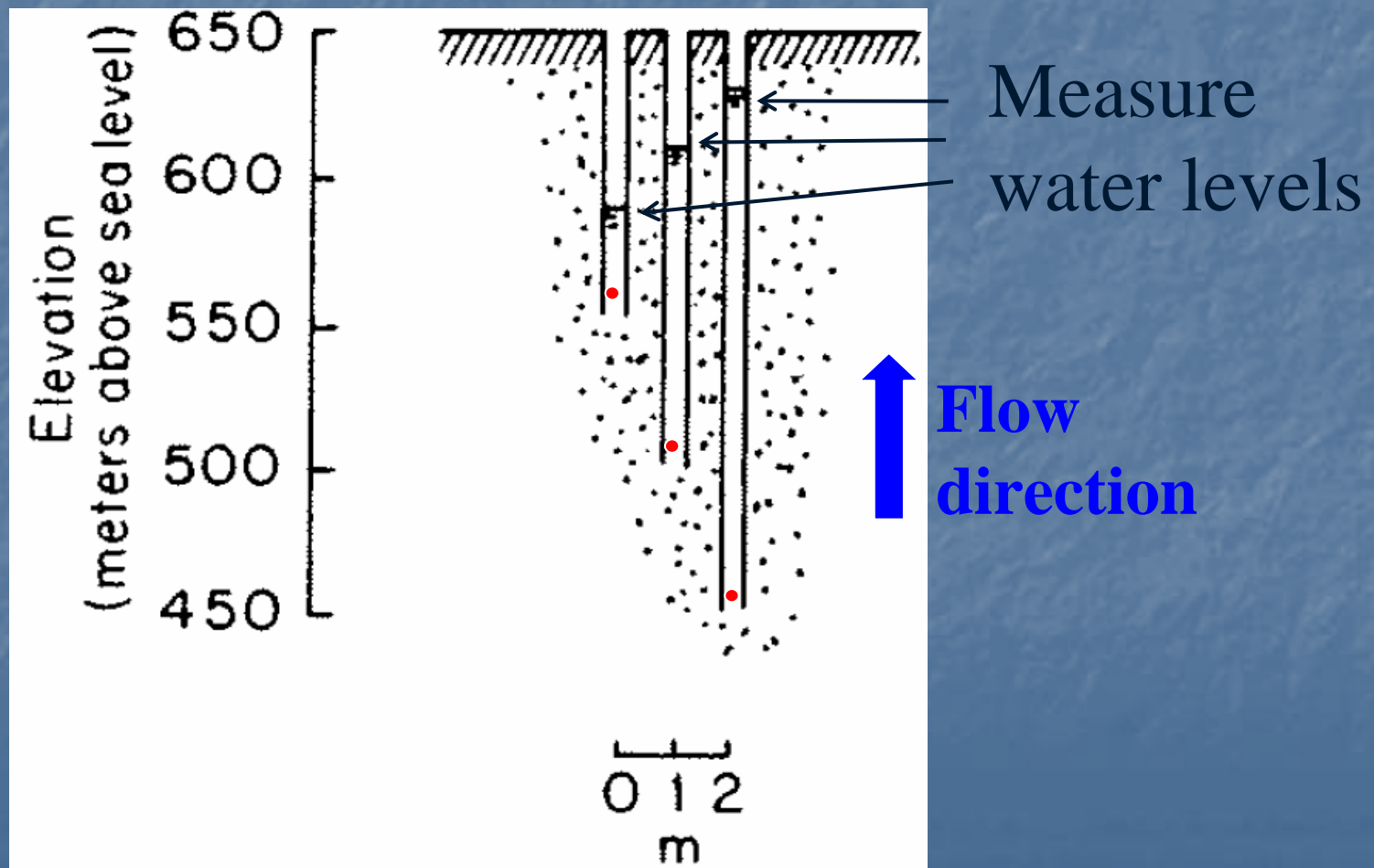
- Determine groundwater gradients:
 - Horizontal flow

Measure water levels



Why measure water levels?

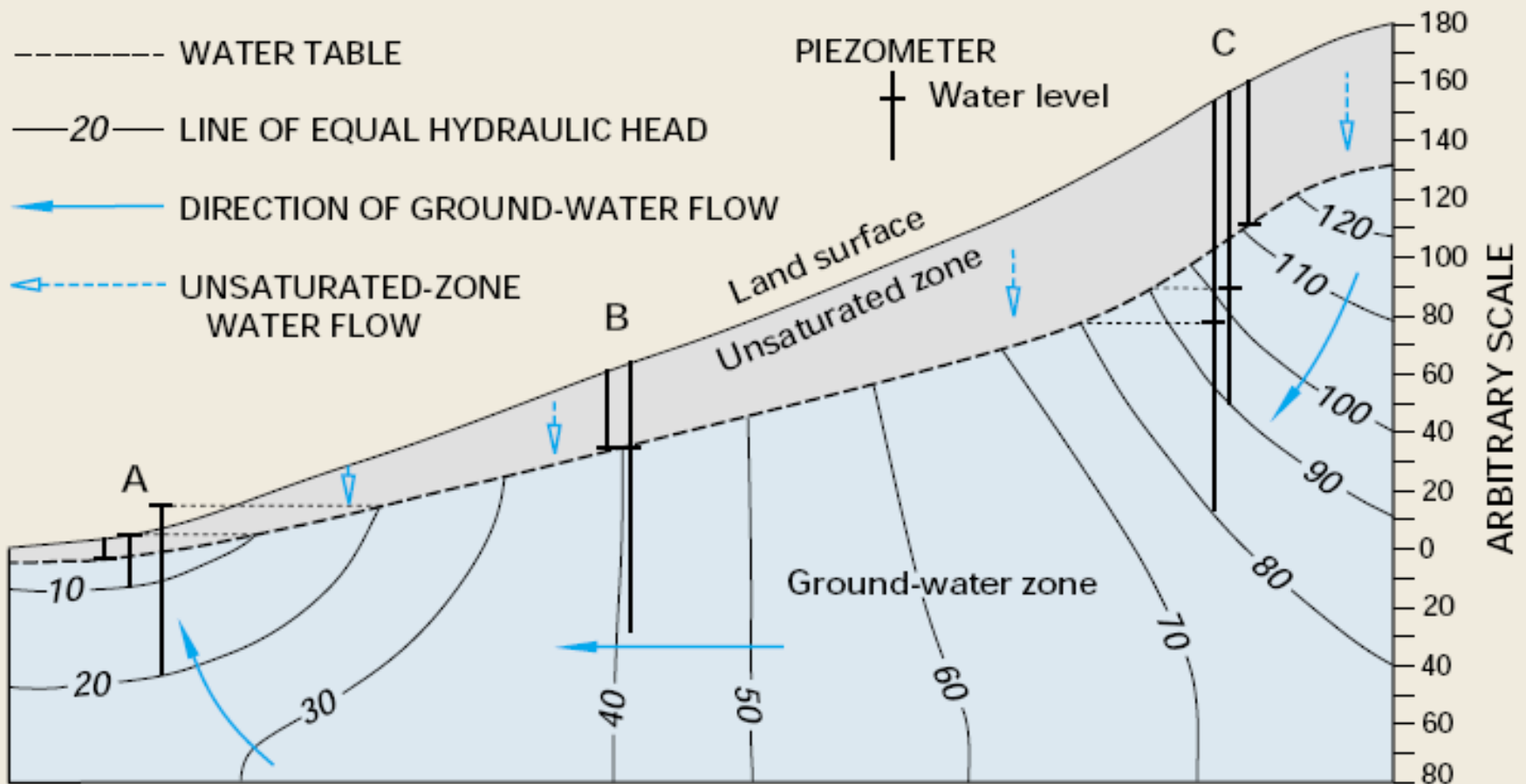
- Determine groundwater flow:
 - Vertical gradients



Why measure water levels?

- Develop groundwater flow maps

EXPLANATION



Why measure water levels?

2. Determine water level in a stilling well connected to a stream or river ("stage");

Convert measured water levels to discharge, as water level is easy to measure and discharge is not (as we will see later!);

Measuring water levels in a stream

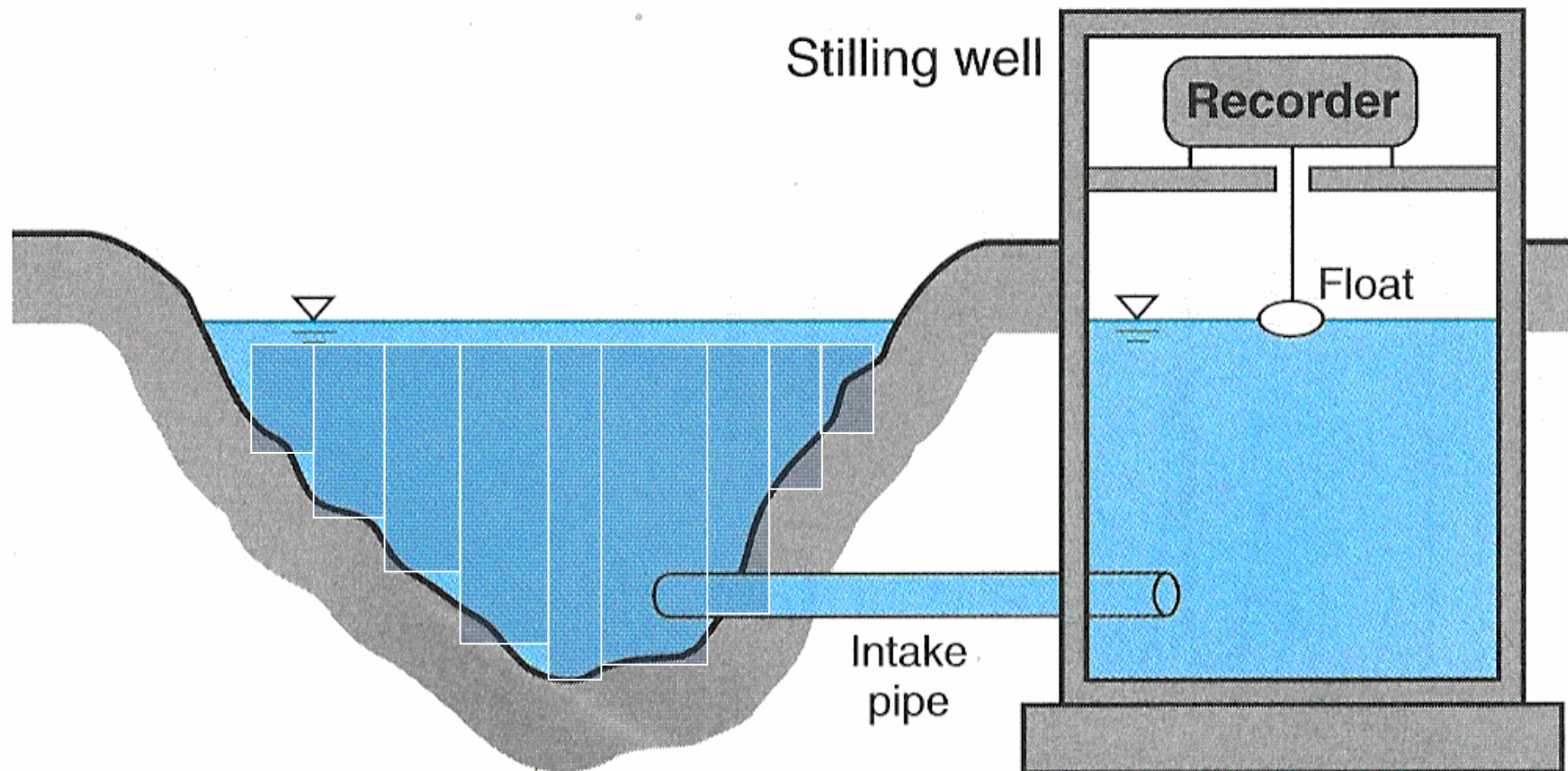
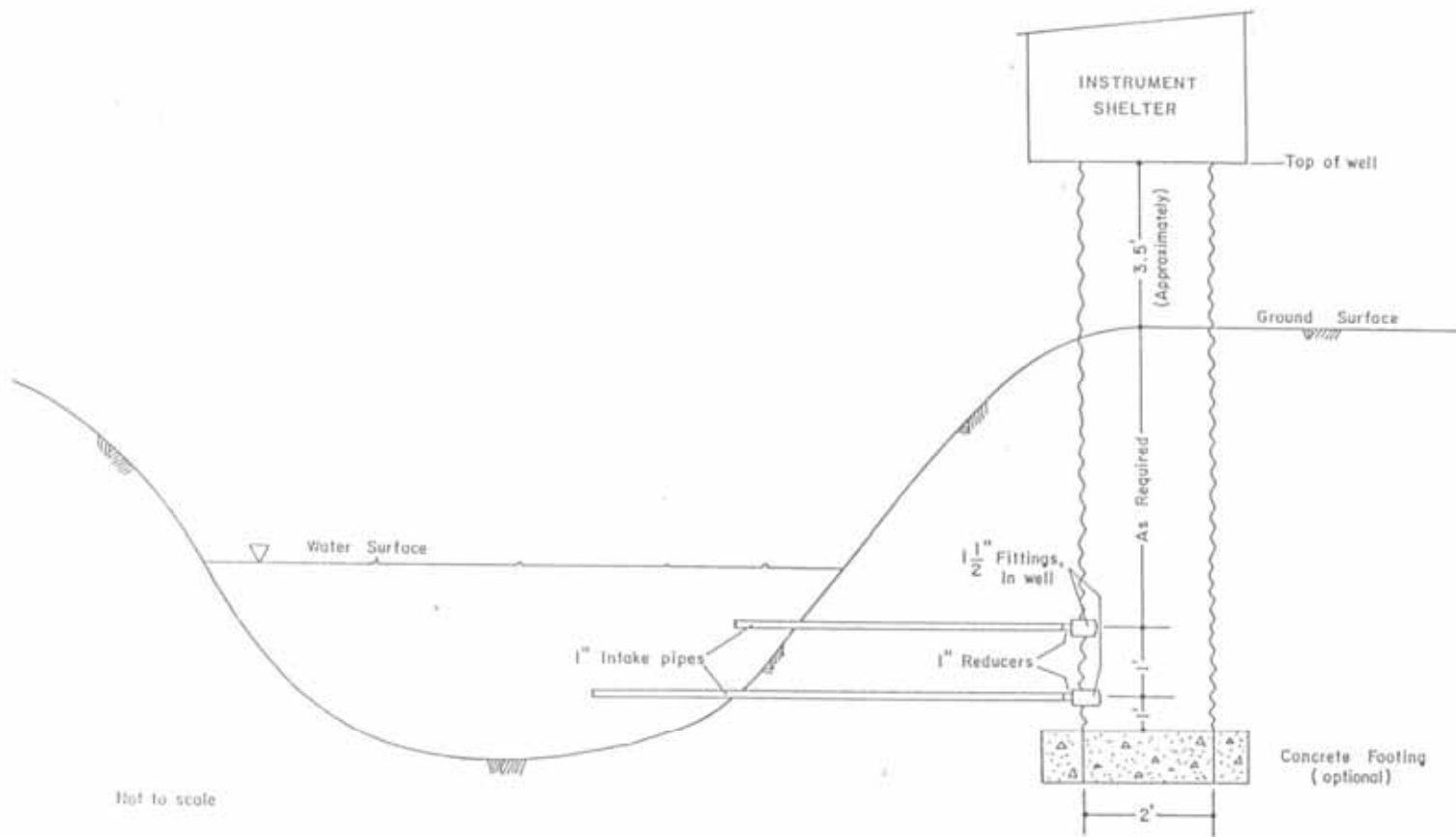


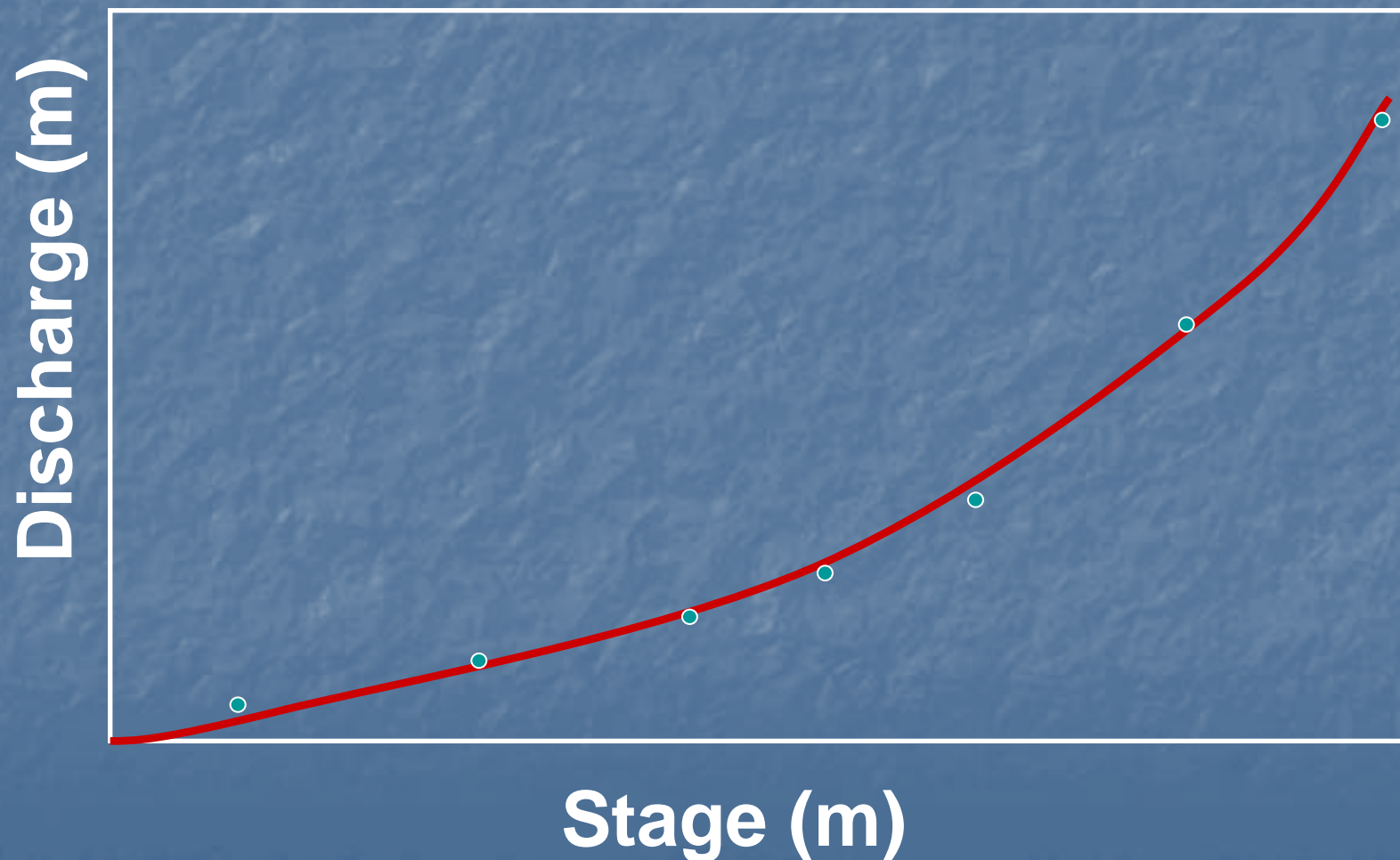
Figure 5.2 Schematic diagram of a stream gaging station used to record flow depth (stage) as a function of time. The resulting stage hydrograph can be converted to a discharge hydrograph using a rating curve.



TYPICAL CULVERT-PIPE STILLING WELL WITH INSTRUMENT SHELTER

PROVIDED BY: USGS - MONTANA DISTRICT OFFICE

Convert water level (stage) to discharge with a rating curve



DISCHARGE RATINGS AT GAGING STATIONS

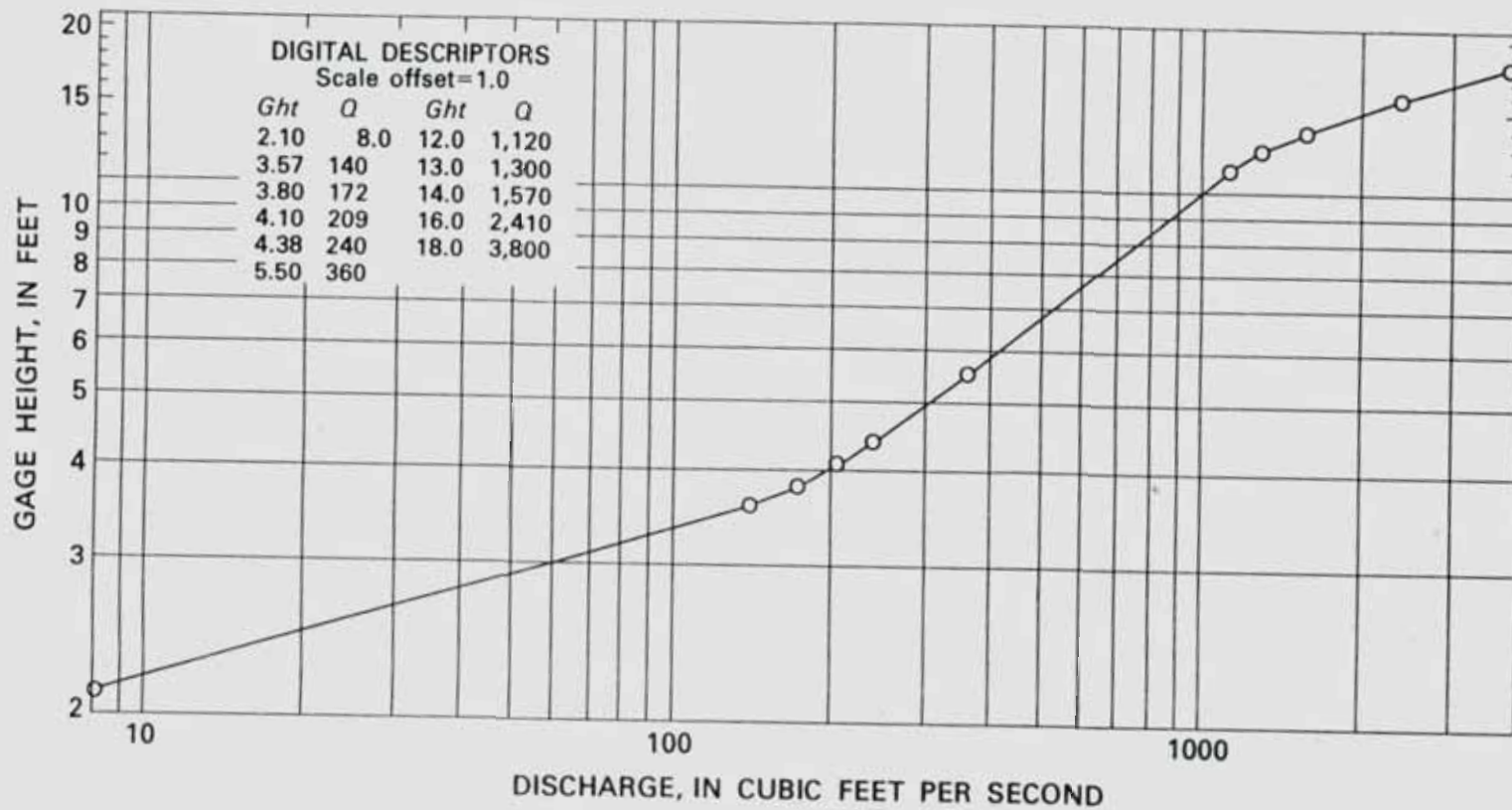


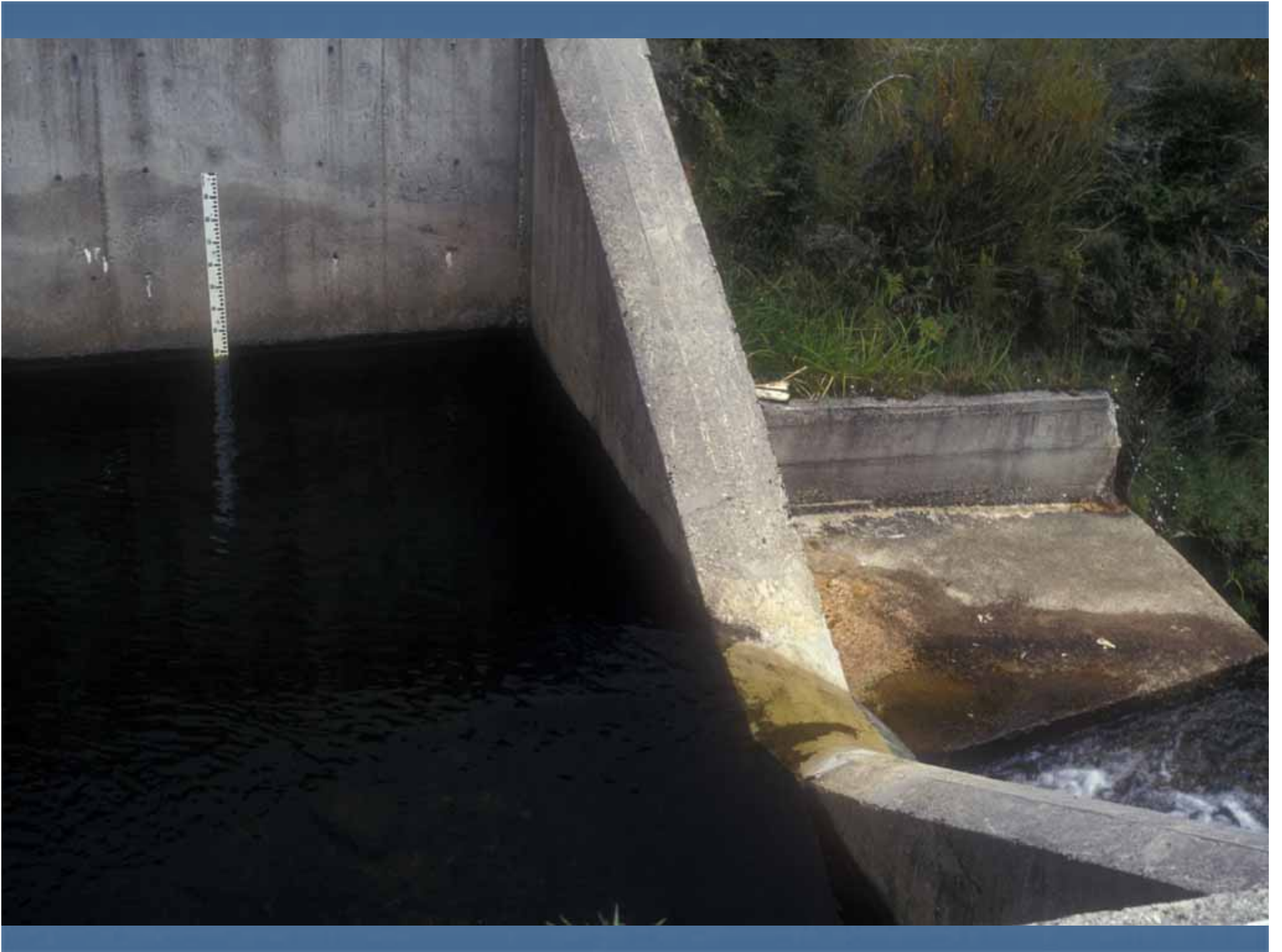
FIGURE 7.—Typical logarithmic rating curve with corresponding digital descriptors.

What time scale do we want to measure at?

- Single measurement in time:
 - Water level indicator (for groundwater);
 - Manual observations against a staff gage (for streams, rivers, lakes);
- Continuous data;

Manual measurements of water levels in streams and rivers

- Measure water level relative to a known elevation;
 - Most commonly a staff gage;
 - In Vietnam more commonly use a series of metal pins set into a set of steps;









How do we continuously measure water levels?

- Traditional:
 - Floats and charts;











How do we measure water levels?

- Traditional:
 - Floats and charts;
- Current:
 - Pressure transducer with a data logger;

Pressure transducers

- Vented

- Have a tube open to the atmosphere, so they automatically adjust for changes in atmospheric pressure;
- Cost about \$400-800, depending on accuracy;

- Unvented

- Less accurate, as no compensation for changes in atmospheric pressure;
- Cheaper (still $>$ \$200).